

5.  $h(x) = \int_0^x g(t) dt$   $h' = \text{slope of } g \therefore h' = g$

a)  $h(4) = \int_0^4 g(t) dt = \frac{1}{4} \pi \cdot 3^2 - \frac{1}{2} \cdot 1 \cdot 2 = \frac{9\pi}{4} - 1$

b)  $[-2, 6]$   $h$  has a rel. min.  
 candidate list  $x = -2$   $h'$  changes from  $+$  to  $-$   
 $x = 5$   $h'$  changes from  $-$  to  $+$  min at 5  
 $x = -2$  min at  $x = -2$  b/c  $h' > 0$  near  $x = -2$   
 $x = 6$  max at  $x = 6$  b/c  $h' > 0$  near 6

c)  $h'(z) = g(z) = \sqrt{5}$   $x^2 + y^2 = 3^2$   
 $z^2 + y^2 = 3^2$

d) inf. pts. when  $f''$  changes sign at  $x = 6$   
 $(h' = g' = \text{slope of } g)$   $x = 4$

Feb 24-9:03 AM

Review 6 Average & Instantaneous Rates of change

ave rate  $\frac{f(b) - f(a)}{b - a}$

inst. rate  $\lim_{b \rightarrow a} \frac{f(b) - f(a)}{b - a}$

$f'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$

ave rate approximates the inst. rate

The graph shows a parabola  $f(x) = x^2$  with points  $(a, f(a))$  and  $(b, f(b))$ . A secant line connects these points, and a tangent line is shown at  $(a, f(a))$ . The average rate of change is the slope of the secant line, and the instantaneous rate of change is the slope of the tangent line.

Feb 24-9:46 AM

EX 1

time (min)	0	4	8	12	16
Temp ( $^{\circ}\text{C}$ )	65	68	73	80	90

a) Estimate the instantaneous rate at  $t = 10$

b) Explain the meaning of the result from part (a)

a)  $\frac{80 - 73}{12 - 8} = \frac{7}{4} \text{ } ^{\circ}\text{C/min}$  b) temp. increasing at a rate of about  $\frac{7}{4} ^{\circ}\text{C/min}$  when  $t = 10$

Feb 24-10:00 AM

EX 2. A falling rock travels a distance of  $16t^2$  ft. ( $t$  in seconds)

a) Find the average velocity on the interval  $[2, 2.1]$

b) Does the ave vel. in part (a) under or overestimate the inst. vel. at  $t = 2$ ? Justify.

a)  $\frac{16(2.1)^2 - 16(2)^2}{2.1 - 2} = 65.6 \frac{\text{ft}}{\text{sec}}$

b)  $f'(2) = 32.2 = 64 \frac{\text{ft}}{\text{sec}}$   
 $65.6 > 64$

The graph shows a parabola  $d(t) = 16t^2$  with points  $(2, 64)$  and  $(2.1, 68.16)$ . A secant line connects these points, and a tangent line is shown at  $(2, 64)$ . The average velocity is the slope of the secant line, and the instantaneous velocity is the slope of the tangent line.

Feb 24-10:16 AM